AD-A139 039 EFFECTS OF STRESSORS ON TASK PERFORMANCE AND SATISFACTION(U) MILTON S HERSHEY MEDICAL CENTER HERSHEY PA DEPT OF BEHAVIORAL SCIENCE S STREUFERT ET AL. 1/1

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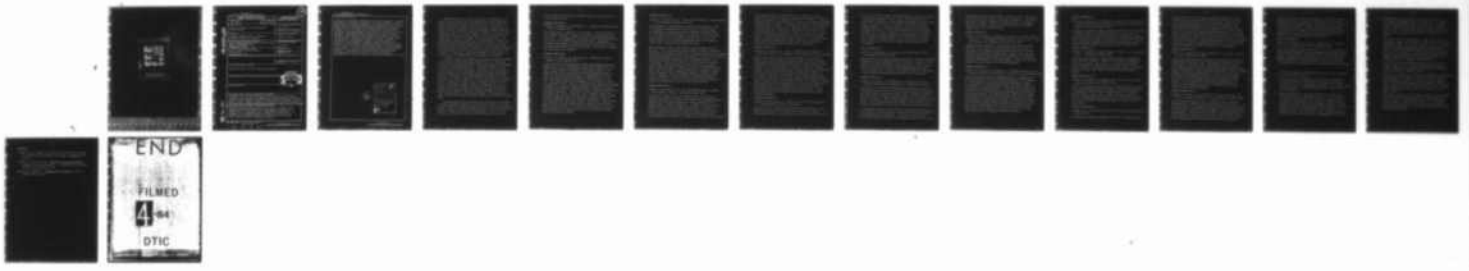

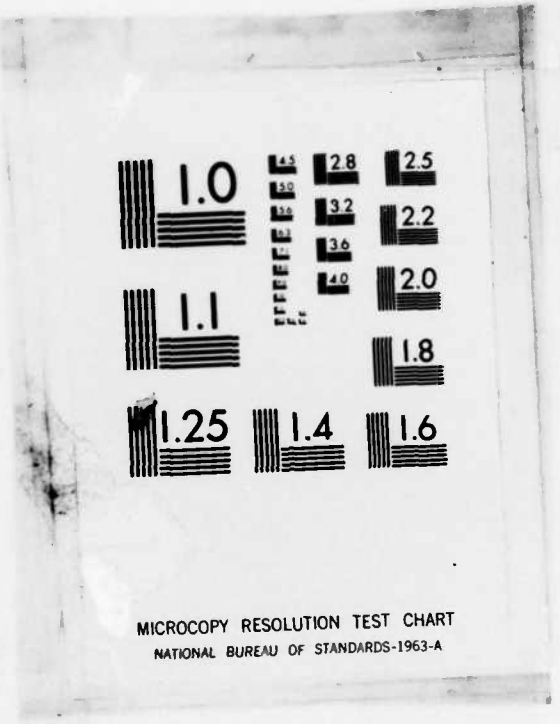
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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Final Report	2. GOVT ACCESSION NO.: AD-A139039
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): Effects of stressors on task performance and satisfaction	5. TYPE OF REPORT & PERIOD COVERED: Final Report
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Siegfried Streufert, Susan C. Streufert, Rosanne M. Pogash, Ann L. Denson	8. CONTRACT OR GRANT NUMBER(s): N00014-80-C-0581
9. PERFORMING ORGANIZATION NAME AND ADDRESS: The M.S. Hershey Medical Center, Penn State Univ. Dept. of Behavioral Science, 500 University Drive, Hershey, PA 17033	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: NR 170-904
11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research, Code 442, Quincy Street, Arlington, VA 22217	12. REPORT DATE: February, 1984
	13. NUMBER OF PAGES: 11
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report)
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release, distribution unlimited.

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

accidents, affect, arousal, attitudes, behavioral styles, blood pressure, challenge, cognition, cognitive complexity, Cognitive Complexity Interview, cognitive style, complexity, complexity theory, complex environments, complex tasks, computers, computer simulation, consistency, coronary prone behavior, crowding, decision making, decision matrix, decisions, diastolic blood pressure,

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The present report presents a summary of efforts on a research project concerned with stressor effects on task performance (in simple and in complex tasks), on satisfaction and on physiological responsivity. The orientation of the research project is discussed. Abstracts of all technical reports prepared during the contract period are presented. Finally, some of the major findings are listed.

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unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

19 Key Words continued

differentiation, dimension, dimensionality, disaster, dissonance, enjoyment, environment, environmental psychology, errors (in performance), executive decision making, experimental simulation, experimentation, free simulations, games, general incongruity adaptation level, hand-eye coordination, heart disease, heart rate, incongruity, incongruity adaptation, information, information load, information search, information utilization, input, integration, laboratory research, life stress, load, load novelty, managers, measurement, multidimensionality, nonsocial tasks, output, overload, performance, physiological arousal, physiological reactivity, planning, planning quality of decisions, predictability, pressor responses, problem solving, quality of performance, quantity of decisions, quantity of performance, quasi-experimental simulation, quasi-experimentation, reliability, research methods, respondent behavior, resting, retaliatory behavior, risk, risk taking, role playing, satisfaction, scenario, simple tasks, simulation, social interaction, speed, strain, strategic behavior, strategy, stress, stressors, style, systolic blood pressure, task, task difficulty, task performance, Three Mile Island, time/event matrix, time urgency, tracking, Type A, Type A Interview, uncertainty, unidimentionality, variety, visual motor tasks, work environments, work load.

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Stressors affect all of us most of the time. For that matter, the absence of stressor impact would be as detrimental and as disconcerning as excess stressor load (Streufert and Streufert, 1978). Unfortunately, too little is yet known to develop a clear understanding of stressor impact on perceived stress, physiological strain, attitudes and satisfaction with work settings and, most of all, task performance. During the last decade we have learned that stressors often impact different persons and different tasks differentially. We know, for example, that the same stressor may aid in simple task performance but hinder complex task performance. We know, that males may be quite differently affected by certain stressors than females. We know that multiple stressors often interact to provide unforeseen outcomes. We also know that it is difficult to generalize from one stressor situation to another. In other words - despite the thousands of research efforts on stressor impact, our knowledge tends to be fragmented and incomplete.

The present research was initiated to move toward more general knowledge of the effects of stressor experience on human adults. For that purpose, the research considered several stressor outcomes simultaneously and attempted to establish relationships among them: we measured a number of diverse kinds of simple and complex performance, we obtained data on task enjoyment and task satisfaction and we repeatedly gathered noninvasive physiological data while participants in the research engaged in controlled and stressor laden work. We utilized a number of levels of stressor impact on participants, both in a simple and in a complex task. We measured the effects of single as well as of multiple stressors. Finally, we determined the effects of specific stress and/or performance related stylistic individual difference variables such as Type A Coronary Prone Behavior (Rosenman and Friedman, 1961), cognitive complexity (Streufert and Streufert, 1978; Streufert and Swezey, in press) and of general incongruity adaptation (Streufert and Streufert, 1978).

The data obtained and the conclusions drawn from that data have helped to provide considerable insights into stressor effect differences and commonalities. The data are reported in seventeen technical reports and have appeared or will yet appear in various articles and chapters in scientific journals and books. To provide an overview, the following pages will contain the

titles, authors and abstracts of the Technical Reports that have been based on this research project:

TECHNICAL REPORT ONR #1:

Streufert, S., Nogami, G.Y. and Streufert, S.C. Stress and incongruity theory: Effects of crowding (1981).

This report focuses on crowding as a stress inducer. Incongruity Adaptation Theory (GIAL) is applied to crowding as a predictor of task performance and satisfaction. It is suggested that crowding may produce pleasant and unpleasant social and work environment conditions and may result in improvements of decrements of performance. The conditions which should produce each outcome are specified according to GIAL theory predictions. Joint effects of crowding and other stressors are considered.

TECHNICAL REPORT ONR #2:

Streufert, S., Streufert, S.C. and Gorson, D.M. Time urgency, load and managerial decision making (1981).

Previous research has demonstrated that optimal complex managerial decision making tends to occur at intermediate information load stressor levels. The present research considers time urgency as an additional variable. Time urgency has been shown to be relatively common among managers (as part of the Type A Coronary Prone Behavior Pattern). Many managers believe that their time urgent stylistics are necessary to guarantee success at their jobs. Since urgency requires rapid responding, it may, however, be viewed as an additional stressor. The latter conceptualization would predict decrements in complex and improvements in simple performance. Experimentally induced time urgency was utilized to determine the effects of urgency on three measures of managerial performance. It was found that time urgency interacts with information load to produce performance outcome. Moderately complex planning and decision making was found to be optimal at intermediate load levels, but disintegrated when time urgency increased to high levels. Similar results were obtained for long-term complex planning. Simple retaliatory decision making increased with load. It is concluded that managerial activities which require complex decision making and long term future planning are hindered rather than aided by time urgency.

TECHNICAL REPORT ONR #3:

Streufert, S. and Streufert, S.C. Stress and the measurement of task performance: I. Decision making in complex tasks (1981).

The development of an overall theory of stress has been hindered by a lack of comparability among research efforts in terms of the tasks utilized, the performance criteria measured, and the measurement techniques applied. In a step toward facilitating research in a complex, as well as some simple settings which can be used to develop an overall theory of stress, this report presents a set of decision making measures which can be applied in a wide variety of experimental and applied situations.

Based on Complexity Theory, nine categories of decision making styles are described: The low unidimensional decision maker, the normal unidimensional decision maker, the general differentiator, the closed hierarchical differentiator, the excessive differentiator, the low level integrator, the high level integrator, the closed hierarchical integrator, and the non-closing integrator. Ten different decision measures are defined and formulas for their calculation are presented: Decision categories, spread across decision categories, number of decisions, number of integrations, Quality of Integrated Stategies (QIS), number of respondent decisions, characteristic response and response speed to information, quality (if immediate response is required), quality (if novel stragegy is required) and quality (if learned pre-established strategy is required). For each of the decision making styles, predictions are made about performance on each of the ten decision measures.

TECHNICAL REPORT ONR #4:

Streufert, S. and Streufert, S.C. Stress and information search in complex decision making: Effects of load and time urgency (1981).

The effects of information load (low, medium and high) and time urgency (absent/control, moderate and high) on three measures of information search/information utilization were investigated in a complex simulated decision making situation. Measures obtained were: 1) number of information search decisions generated by four-man teams participating in the simulation, 2) number of integrations based on their previous information search decisions (a measure which previous research has shown to predict successful high level organizational performance), and 3) number of respondent actions associated

with information search (a measure which previous research has shown to relate to lower levels of successful organizational performance). Previously reported data showing that intermediate load levels result in optimal integrative performance were corroborated. Increases in time urgency resulted in decreases in search activity in general, and in integrative utilization of information obtained through search in particular. High levels of time urgency in association with high load levels resulted in fewer search decisions and complete absence of integrative utilization, but produced an increase in respondent actions. The data suggest that an optimal environment for high level decision makers with planning responsibility should contain optimal intermediate load levels, but should be kept relatively free of time urgency.

TECHNICAL REPORT ONR #5:

Streufert, S., Streufert, S.C., Lewis, J., Henderson, R. and Shields, J.L. Differential effects of four stressors on blood pressure and heart rate (1982).

Before we can progress further toward the development of a more general theory of stress and performance in work environments, we need to determine whether diverse stressors produce different types of stress (strain) responses in addition to the different levels of response that have been frequently observed. In the present experiment, four stressor conditions are systematically compared in their effects on blood pressure and heart rate responses. It was found that three stressor environments which differed from each other on a number of variables but had a social setting in common produced diverse degrees but similar kinds of blood pressure and heart rate responses. Different kinds of stressor responses were obtained in a non-social (video game) hand-eye coordination task. It is suggested that if future research extends this finding to the stressor-performance relationship, theories of stress and performance will have to consider complex interactions among a number of relevant variables.

TECHNICAL REPORT ONR #6:

Streufert, S. and Streufert, S.C. Effects of load stressors on performance in a multidimensional visual-motor task (1982).

Previous research on complex decision making has supported complexity theory predictions concerned with the effects of load stressors on a number of decision-making variables. Considerable data are now available on the effects

of load on both simple respondent and complex integrated strategic performance in complex decision-making settings. Data on simpler performance tasks (e.g., hand-eye coordination or other problem-solving tasks) have been collected as well, but typically fall into the category of load effects on simple respondent behaviors. The present research was designed to systematically investigate the effects of load upon both respondent and strategic behavior in simpler tasks. A hand-eye coordination task was specifically developed for this research to permit comparison to data from more complex decision-making settings. Considerable similarities of load effects on performance in the present task to load effects in complex decision-making settings were observed.

TECHNICAL REPORT ONR #7:

Streufert, S. and Swezey, R. W. Simulation and related research methods in environmental psychology (1982).

Research efforts in environmental psychology often involve complex environments requiring specifically designed experimental technology to permit both causal inference and reliability/validity of the obtained data. A number of research methods centering around simulation and gaming methodologies are examined for their applicability to problems in environmental psychology. Among others, a recently developed quasi-experimental simulation method is discussed.

TECHNICAL REPORT ONR #8:

Streufert, S. Streufert, S.C. and Denson, A.L. Information load stress, risk taking and physiological responsivity in a visual-motor task (1982).

The effects of four levels of information load on physiological responsivity (blood pressure and heart rate) and on risk taking were analyzed and compared to previous results concerning the effects of load on performance. Twenty-five adults participated in a hand-eye coordination task of moderate complexity. The task was designed to permit strategic responding, risk taking and retaliatory behavior. Risk taking was measured as the degree to which subjects acted to increase the probability of a major loss in the face of potential minor gains.

It is argued that an expected stress effect on risk taking and performance can be defended only if load would result in elevated arousal with risk taking and with decreasing levels of performance. It was found that participation in the present task was associated with some degree of arousal and that persons

with greater (diastolic) arousal tended to take greater risks. Load affected risk taking but was not related to physiological responsivity. The potential that load as a stressor functions as a cognitive modifier of performance, and does not represent a precursor of strain (and stress), is considered. Suggestions for future research are made.

TECHNICAL REPORT ONR #9:

Streufert, S., Streufert, S.C., Denson, A.L. and Houts, P. Stressor effects in lab and life: Correspondences between the effects of the accident at Three-Mile Island and stress responses in the laboratory (1982).

Persons with diverse responses to the Three Mile Island nuclear accident (residents of the ten mile area around the power plant) were placed in a laboratory stress environment to compare stress responses in lab and life. Considerable correspondences between persons' responses to TMI (attitudes and excess visits to medical services) and their elevations of (especially diastolic) blood pressure in the lab were obtained. The data are considered evidence for external validity of lab stressor procedures.

TECHNICAL REPORT ONR #10:

Streufert, S., Streufert, S.C. and Denson, A.L. Cognitive complexity, Type A behavioral style and load as predictors of visual-motor task performance (1982).

Effects of cognitive complexity (multidimensionality vs. unidimensionality and of Type A behavioral style (a coronary prone behavior) on four measures of task performance in a visual-motor task were investigated. Subjects were exposed to four load levels which produced task settings ranging from relatively easy to extremely difficult. It was found that increasing load increases both risk taking and errors, and decreases strategic planning and overall task performance. More multidimensional (complex) persons engaged in considerably more strategic planning and made fewer errors than their more unidimensional (less complex) counterparts. Differences between these two groups were particularly evident at higher (more stressing) load levels. Type A Coronary Prone Behavior had no effects on performance whatsoever. Implications of these findings for the Type A personality and for tasks requiring some degree of planning or strategy are discussed.

TECHNICAL REPORT ONR #11:

Streufert S., Streufert, S.C. and Denson, A.L. Effects of four task stressors on blood pressure responses in persons differing in Type A coronary prone behavior and cognitive complexity (1983).

The effects of differences in Type A coronary prone behavior and of differences in cognitive complexity on physiological arousal in a visual motor task, a social baseline condition and two interviews were investigated and compared to non-social baseline readings. Tasks differed in arousal levels generated. Type A and cognitive complexity affected physiologic responsivity primarily in terms of response variability rather than in terms of response level.

TECHNICAL REPORT ONR #12:

Streufert, S. Measurement of task performance on the basis of the time/event matrix: An extension of methods (1983).

Previously reported measures of complex task performance are supplemented with a number of new measures. Formulas for calculating all measures now utilized are presented. Data collection on the basis of the time/event matrix is explained. Information about the print-out numbers of the various measures for some recently developed complex man-machine simulations is provided.

TECHNICAL REPORT ONR #13:

Streufert, S., Streufert, S.C. and Pogash, R.M. Effects of load, cognitive complexity and Type A on satisfaction (1983).

Effects of information load on satisfaction as modified by Type A vs. Type B and by Cognitive Complexity were investigated. Satisfaction decreased with increasing task difficulty (load) but was particularly low for persons of Type A and cognitive simple styles. Similar results were obtained for a measure of Enjoyment Despite Dissatisfaction which accounted for motivation in the face of challenge. Relationships between job and task satisfaction are considered.

TECHNICAL REPORT ONR #14:

Streufert, S.C. Task differences, stylistic characteristics and physiological arousal (1983).

This research was designed to determine the effects of cognitive/behavioral

styles, in general, and of the General Incongruity Adaptation Level (GIAL), in particular, on physiological arousal under a variety of task conditions. It was found that load stressors in many cases produce changes in blood pressure levels which appear to parallel previous findings showing them to be related to various indices of task performance. Particularly the GIAL style (and to lesser degrees cognitive complexity and Type A, in that order) appear to mediate when load stressor effects on arousal do occur. The present research provides the basis for planned research efforts which will be concerned with potential covariation of task performance measures (such as risk taking and utilization of strategy) and physiological responsivity, as they are jointly affected by behavioral styles and task stressor (e.g., load) levels.

TECHNICAL REPORT ONR #15:

Streufert, S. Cognition and arousal as predictors of risk taking: Effects of load and cognitive style (1983).

The research investigated the contributions of three cognitive styles (Type A, Cognitive Complexity and the General Incongruity Adaptation Level - GIAL) on risk taking in a visual motor task. The research was further concerned with uncovering possible relationship between these cognitive styles and physiological (cardiovascular) arousal as sources of risky action. Effects of stylistic variables on risk taking appeared frequently at specific task load levels. Only limited relationships between arousal and risk taking were obtained. Arousal did not covary meaningfully with stylistic antecedents of risky behavior. It was concluded that risk taking is primarily cognitive in orientation and interventions to decrease risk taking on the job should focus on relevant cognitive approaches.

TECHNICAL REPORT ONR #16:

Pogash, R.M., Streufert, S. and Streufert, S.C. Cognitive complexity, task load and task speed as predictors of task satisfaction and enjoyment (1983).

This research investigated the effects of information (work) load and of individual stylistic differences in cognitive complexity on satisfaction. Subjects participated in an experimental visual motor task in which task speed and load were varied. Satisfaction with and enjoyment of participation/performance were measured. As reported in previous research, cognitive complexity does affect satisfaction. However, multiple stressor (load plus speed at excessive levels) diminishes the differences between more versus less cognitively

complex individuals. In general, increasing task difficulty (as manipulated and perceived) resulted in decreasing satisfaction with task performance. Enjoyment of the task decreased with increasing load but increased marginally with increasing task speed. It appears that satisfaction and enjoyment are two quite distinct phenomena. While cognitive complexity has no effect on satisfaction at high load levels, it does distinguish among persons' enjoyment of a task presented under high load conditions.

TECHNICAL REPORT ONR #17:

Pogash, R.M., Streufert, S.C., Denson, A.L. and Streufert, S. A player's manual for a complex disaster decision simulation (1984).

This technical report contains the participant's manuals for a complex micro-computer assisted experimental decision making simulation which may be used to assess decision making characteristics (fifteen or more computer scored measures of performance quantity and quality such as use of strategy and decision coordination) of individuals or teams. The scenario is geared to a disaster event but may be modified to fit any complex decision environment.

Some of the findings of the present research that aid in the development of an overall theory of stress are:

1. Self-induced stressors as measured as "Type A" Coronary Prone Behavior do affect physiological arousal (strain) and self-perceived "stress" but show little, if any, relationship to performance. Type A characteristics do, however, impact on perceptual stress experiences and their sequels such as satisfaction.

2. Cognitive Complexity is a significant predictor of both physiological arousal (strain) and of complex task performance (e.g., the utilization of strategy). Individual differences in cognitive complexity affect strategic and related behavior in diverse <u>kinds</u> of tasks, varying from visual-motor settings to complex decision making environments. Differences among more complex (more multidimensional) and less complex (more uni-dimensional) persons are most evident at optimal (intermediate) stressor levels which reflect the general absence of <u>Perceived</u> stress experience.

3. Different kinds of tasks produce not only diverse levels but also different kinds of physiological strain. Since that strain is directly related to task performance, we must be concerned with understanding the kind of strain that is generated by any one or any combination of stressor events. In particular, it appears that social stressor settings differ greatly from nonsocial settings in the kind of strain that is evoked.

4. Load stressor impact is, when it exceeds a moderate level, generally detrimental to complex task performance, no matter what the task. Load stressors may, however, have favorable effects on simple task performance until the maximum adequate performance level of the person/group is reached. At that point performance quantity will level off and quality will diminish. Time Urgency as a secondary stressor exaggerates load effects, strongly diminishes complex performance quality and just about eliminates openness to or search for needed information.

5. It was found that while risk taking is related to load stress and to diastolic arousal, there is no three-way relationship between these variables. Apparently risk taking is based on cognitive decision processes and not directly on affective arousal.

6. Satisfaction is decreased by load stress and to some extent by the rapidity with which persons must respond to their task environment. However, rapid responding may increase the enjoyment of the task. Apparently satisfaction and enjoyment are quite different phenomena. Where load stress is restricted to optimal or below optimal levels, more cognitively complex individuals appear to generate more satisfaction with their work environment.

7. Both cognitive complexity and GIAL (general incongruity adaptation level) differences among individuals are predictors of task performance and arousal. Measures of these concepts, when factors, yield a number of separate predictor variables which are variably tied to performance and arousal at diverse levels. Future research should carefully explore these separate predictors.

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